2016

2016 Annual Report Building Drought Resilence

Kelly Smith

2016
ANNUAL REPORT

NATIONAL DROUGHT MITIGATION CENTER
NDMC
AT THE UNIVERSITY OF NEBRASKA-LINCOLN

BUILDING DROUGHT RESILIENCE

NATIONAL DROUGHT MITIGATION CENTER

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www.drought.unl.edu

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Cover design and layout: Shawna Richter-Ryerson

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LETTER FROM THE DIRECTOR

I want to welcome you to the National Drought Mitigation Center's inaugural Annual Report. In helping compile this report, I was reminded of the depth and diversity of activities, services and research we are involved with, not just here in Nebraska, but across the nation and world. I hope you see that, too, as you read stories highlighting some of the great work being done by our staff and students. You also can get a taste for what we do by checking out a map featuring some of our work on page 16.

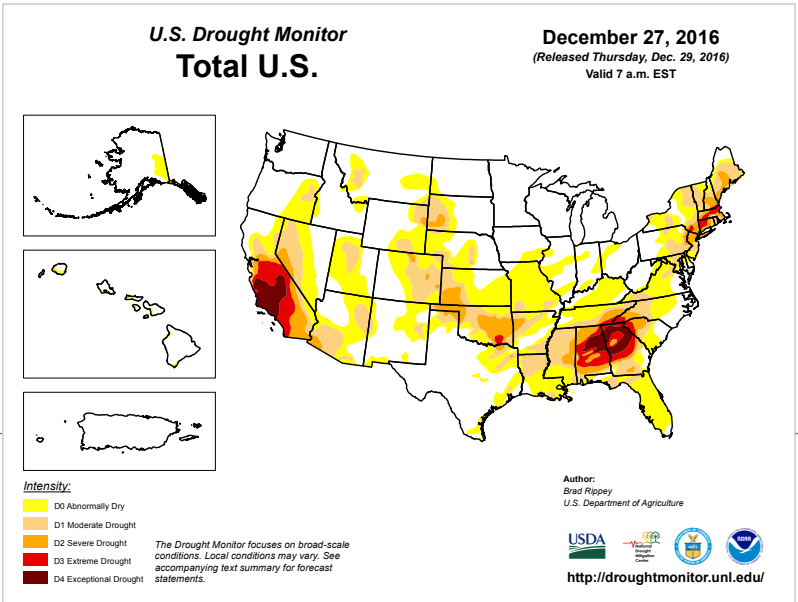
The NDMC team is dedicated to continuing and expanding on the mission we began with 1995: to help people reduce the effects of drought. It was the mission founding director Dr. Don Wilhite emphasized and the one former director Dr. Mike Hayes continued to carry out. It is a privilege to follow in their footsteps. But we couldn't have done it without you, our partners, who helped us build a body of work that put the drought center and the University of Nebraska-Lincoln on the global map as "the" go-to resource for drought risk management.

As we move into our third decade of existence, we are excited to announce a fresh look for the NDMC. As of the release of this report, our web portal, social media channels, reports, tools and email updates will now feature a new drought center logo, created to better brand us as the world continues its push toward digital communications. Even though our logo has changed, our commitment to helping society reduce its risk to drought remains the same as does our high-value research, service work and education and outreach efforts. What we do is all about the water, and our new logo reflects our work across the entire hydrological system with the goal of building a more drought-resilient world.

Thank you for your continued support for, and interest in, the drought center's work. Please visit our website soon to learn more about our ongoing work. It is my hope that I, or a member of my staff, will have a chance to cross paths with you and make 2017 another great year!

Sincerely,

Mark Svoboda, Ph.D., Director



DROUGHTMONITOR.UNL.EDU

The weekly U.S. Drought Monitor map reached more than 7 million viewers in 2016. Its production is a joint effort by the National Drought Mitigation Center, the National Oceanic and Atmospheric Administration and the U.S. Department of Agriculture.

USDM PUTS NATIONAL CONVERSATION ON SAME PAGE

In 2016, the U.S. Drought Monitor was viewed nearly 7 million times — on the Drought Monitor's website alone. The weekly map also is distributed on social media and through media outlets, reaching viewers through Facebook and Twitter feeds and through newspapers and television screens so people can visualize exactly where drought is encroaching.

It is the most widely used gauge of drought conditions in the country and serves as a trigger for federal relief funds, including more than $6 billion paid out to date through the Livestock Forage Disaster Program in the 2014 Farm Bill.

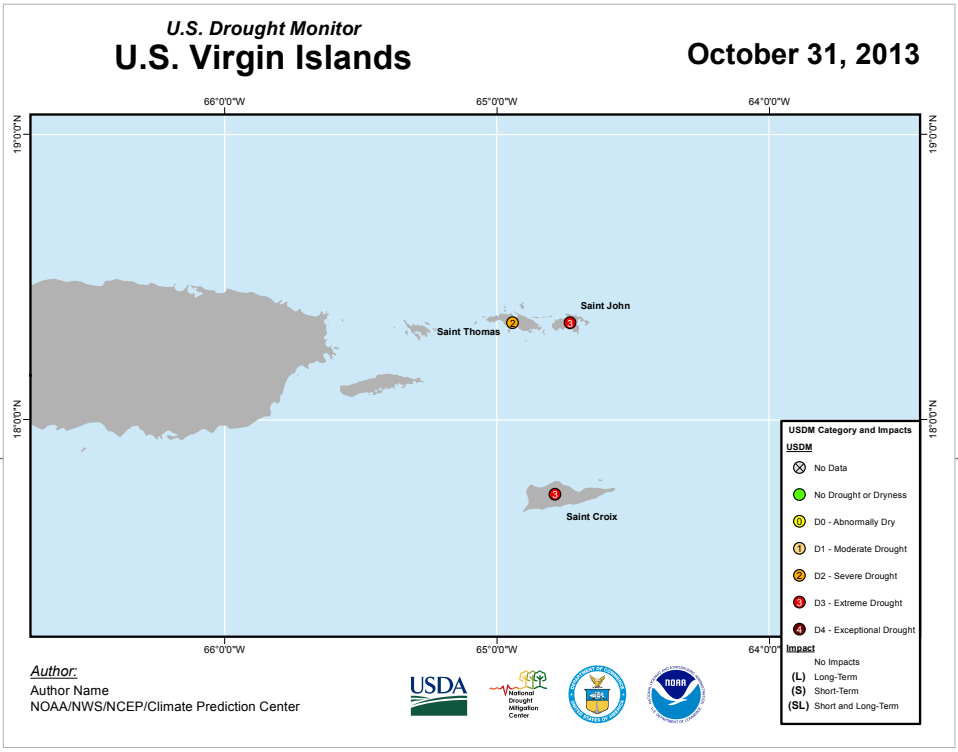
Mark Svoboda, now director of the drought center, was one of two cofounders and seven original authors of the U.S. Drought Monitor. The center currently hosts the U.S. Drought Monitor website, provides two authors, and is the academic partner in its weekly production.

Each week, a U.S. Drought Monitor author revises the previous week's map based on different data inputs, including reports from a nationwide network of expert observers, including state climatologists, Extension agents, Farm Service Agency officers and more. The unique combination of data and ground-truthing has provided credibility that accounts for the U.S. Drought Monitor's increasingly central place in the nation's discussion of drought.

The U.S. Drought Monitor is a joint effort by the drought center, the National Oceanic and Atmospheric Administration, and the U.S. Department of Agriculture.

PARTNERSHIP WITH THE U.S. DEPARTMENT OF AGRICULTURE

Since weekly production of the map began in 1999, the data and tools available to the team of rotating authors has steadily expanded, with the drought center playing a key coordinating role. A partnership with the USDA's Office of the Chief Economist has enabled the drought center to streamline several aspects of the behind-the-scenes Drought Monitor data management and production. The same partnership led to enhancements to a companion tool, the U.S. Drought Impact Reporter, as well as better integration of the DIR with the USDA's drought relief website and with the National Integrated Drought Information System's drought.gov site.



NDMC

This is an experimental drought monitor map for the U.S. Virgin Islands.

BRINGING THE DROUGHT MONITOR TO THE VIRGIN ISLANDS

The Virgin Islands is one step closer to being included in the U.S. Drought Monitor, a national assessment tool that maps drought conditions nationwide on a weekly basis. The drought monitor uses historic and current precipitation and temperature data, economic impacts to agriculture and other climatological factors to determine whether an area is experiencing drought. Many U.S. Department of Agriculture drought relief programs are triggered by USDM drought designation.

In 2015, Virgin Island agronomists and farmers discovered the islands didn't have sufficient data to be included in the U.S. Drought Monitor's weekly assessments.

To address this problem, the USDA and the National Drought Mitigation Center — in partnership with the University of the Virgin Islands, the VI Department of Agriculture, the Virgin Islands Territorial Emergency Management Agency and the National Weather Service — convened a forum to discuss how the territory could enhance data collection and communication to reduce the time it takes for drought to be officially declared and for federal funding to arrive.

Forums were in late August and included St. Croix and St. Thomas agency personnel, farmers, researchers, teachers and students. Together, the groups determined local climatological data needed for the drought monitor is being collected, and historic weather data is available, but the roadblock is getting it converted to GIS format and to USDM authors weekly. Also needing to be collected and provided: indicators such as water costs, economic effects on farmers and other impact data.

"Given what I heard today, there's going to be some time to develop the local resource pool and get that coordinated so the people at the national level can get what they need from us," said Carlos Robles, USDA commissioner to the Virgin Islands. The U.S. Geological Survey will soon be back in the territory to monitor groundwater resources, which is data that could feed into the drought monitor. "Our request to get on the monitor has been heard and the process has been commenced in earnest. Now we understand what it takes to get on and stay on the monitor."

— FROM A REPORT BY JULIE WRIGHT,
USDA NATURAL RESOURCES CONSERVATION SERVICE

NDMC

Nicole Wall, NDMC outreach and research specialist, presents during a stakeholder engagement meeting in September 2016 in Amman, Jordan. Wall and other social scientists also conducted engagement meetings in Tunisia, Morocco and Lebanon.

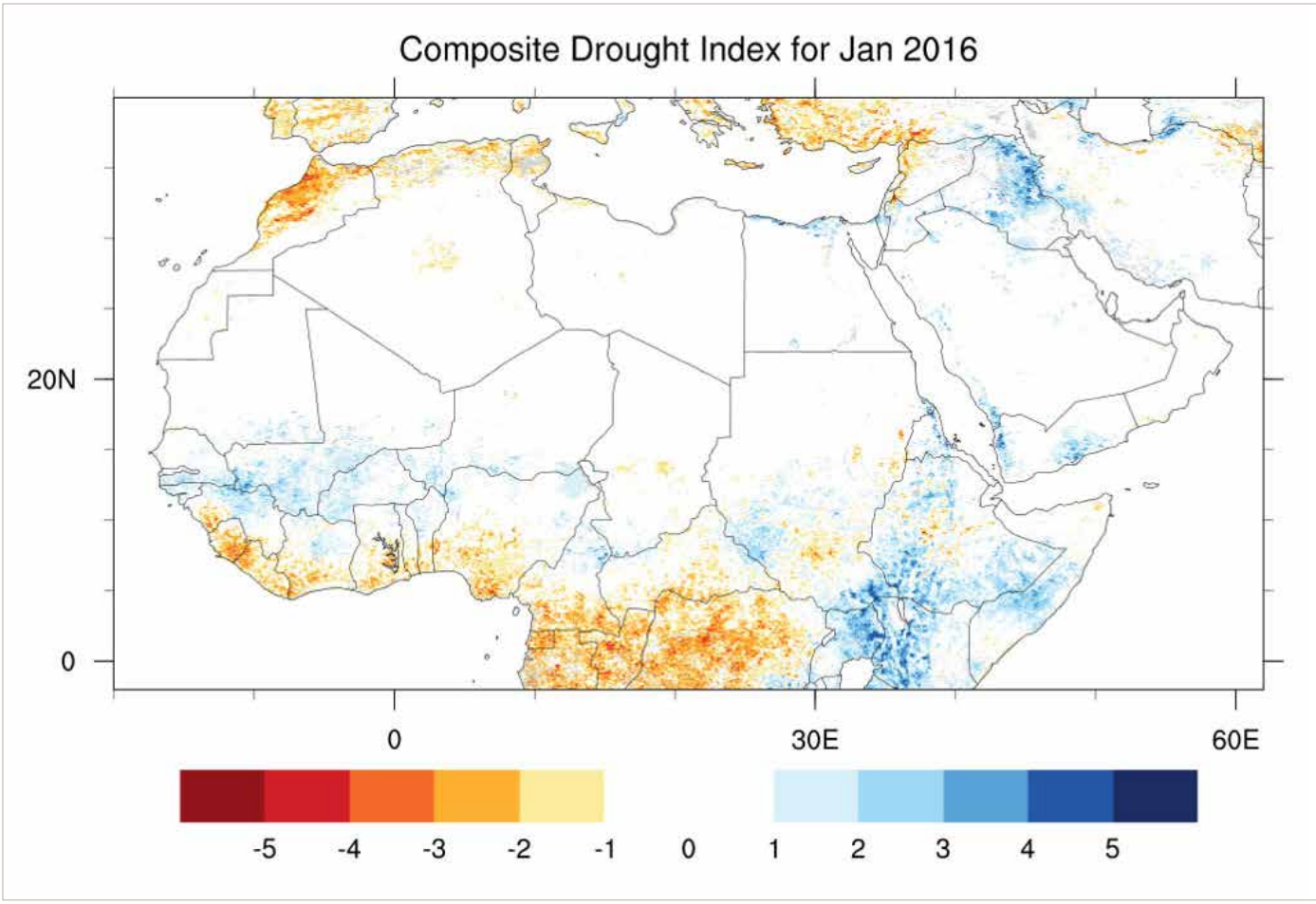
NU CENTERS LEAD DROUGHT PROJECT IN MENA REGION

Workshops in Tunisia, Jordan and Morocco in October introduced country representatives to the new, regional Composite Drought Index, and helped them consider how to tailor the CDI to their own needs.

The National Drought Mitigation Center co-led a $4 million research effort with the Dubai-based International Center for Biosaline Agriculture. The U.S. Agency for International Development funded the one-year project through March 2016, which included a research component with other University of Nebraska groups, the Center for Advanced Land Management Information Technologies and the Robert B. Daugherty Water for Food Global Institute.

NDMC social scientists Cody Knutson, Theresa Jedd and Nicole Wall organized forums in Tunis, Tunisia; Amman, Jordan; and Rabat, Morocco, in October; and in Beirut, Lebanon, in January. With support from the United Nations Food and Agriculture Organization, the first three workshops drew about 80 participants from agencies related to water, health and agriculture, along with others from non-governmental organizations and universities.

The forums were a chance to introduce participants to the Composite Drought Index for each country. The CDI can



NATIONAL DROUGHT MITIGATION CENTER

Three University of Nebraska groups have worked together to create the Composite Drought Index for the Middle East and North African region as part of a research project funded by the Dubai-based International Center for Biosaline Agriculture. The three centers are: the National Drought Mitigation Center and the Center for Advanced Land Management Information Technologies, both at the University of Nebraska-Lincoln; and the Robert B. Daugherty Water for Food Global Institute at the University of Nebraska.

be used to monitor the onset, duration and end of drought. One of the goals of each forum was to gather country-specific feedback on how well the CDI represented past droughts. The forums also helped each country move toward establishing systems for monitoring and managing drought.

Chris Poulsen, drought center GIS developer, traveled to Dubai in December to help transfer the Composite Drought Index at ICBA into open source code. This is a step toward enabling the individual countries to modify the regional CDI to meet their own specific needs.

This effort is part of FAO's Near East and North Africa Water Scarcity Initiative, a 10-year project.

PROJECT FACEBOOK PAGE

facebook.com/Middle-East-and-North-Africa-Drought-Platform-666877780138410/?fref=ts

MIDDLE EAST & NORTH AFRICA PROJECT

In early December, NDMC geospatial analyst Chris Poulsen met with the International Center for Biosaline Agriculture in Dubai, United Nations Emirates, to help move the Composite Drought Index to open-source programming.

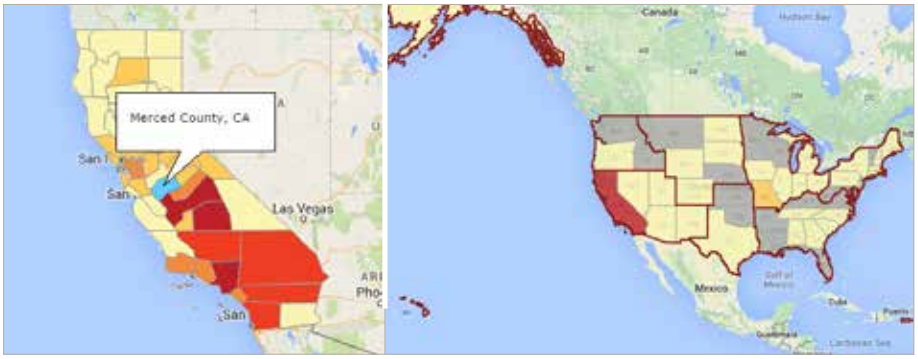
This is one of his views of Dubai.

PHOTO COURTESY CHRIS POULSEN

IMPACT ARCHIVE UPDATES MAKE FINDING LOCAL DATA EASIER

Recent changes to the Drought Impact Reporter make it easier for users to find information about how drought has affected a specific location. Impacts are now aggregated by jurisdictional scale – city, county, state, multi-state, or the whole country, and users can specify a location.

Previously, the web-based tool allowed users to specify a location, but provided impacts at all scales simultaneously, which made it difficult for users to zero in on impacts affecting a single area. Now, if users want impacts for a specific location at all relevant scales, they can do separate searches at each scale.



NATIONAL DROUGHT MITIGATION CENTER

(ABOVE LEFT) One of the new functions of the DIR is to show impacts reported at a county level. The function includes a mouseover showing county and state names, shown in this close-up of California. (ABOVE RIGHT) The latest functions also include overlays, including the USDA Climate Hub regions shown here.

Other enhancements are:

- A more useful view of counties that helps people to find the location of a county within a state.

- A system for letting users navigate directly to a customized view of the Drought Impact Reporter, specifying a state, jurisdictional scale, temporal scale, and one or all categories. This allows webpage administrators to provide users with a live, customized display of the Drought Impact Reporter.

- New overlays, which as of July 2016 included Weather Forecast Offices, Tribal Lands, Regional Drought Early Warning Systems, and U.S. Department of Agriculture Climate Hubs. More are in the works, including a layer that will display USDA Secretarial Disaster Declarations.

The Drought Impact Reporter still allows people to submit observations related to drought via the Submit a Report tab.

The National Drought Mitigation Center launched the Drought Impact Reporter in July 2005, in response to an identified need for a comprehensive national archive of drought impacts. The impact reporter has been supported over the years by a variety of competitive grants and contracts, notably from the USDA, including its Risk Management Agency and from the National Oceanic and Atmospheric Administration's Sectoral Applications Research Program. These latest improvements were made possible by a contract with the USDA's Office of the Chief Economist, and incorporates user feedback gathered in partnership with the National Integrated Drought Information System.

For more information about the capabilities of the Drought Impact Reporter, including detailed help on how to use it, visit *droughtreporter.unl.edu*.

NDMC, TRIBES PARTNER TO ASSESS CLIMATE VULNERABILITY

Cody Knutson and Kelly Helm Smith are providing training and technical assistance to conduct climate vulnerability assessments for the Rosebud Sioux, Oglala Sioux, Standing Rock Sioux and Flandreau Santee Sioux tribes in South Dakota. The team will support the work of the Great Plains Tribal Water Alliance, which is facilitating the project with funding provided by the Bureau of Indian Affairs' Tribal Climate Resilience Program.

The GPTWA is an advisory committee to the Great Plains Tribal Chairman's Association on technical and policy issues regarding the water resources of its member tribes. Other project partners include Louis Berger, an engineering company; NOAA and the National Integrated Drought Information System; the High Plains Regional Climate Center at the University of Nebraska-Lincoln; South Dakota State University; and the South Dakota School of Mines and Technology.

Specifically, the partners will:

1) provide training on conducting climate vulnerability assessments;

2) collaborate with the targeted tribes to assess climate vulnerabilities in their water sectors;

3) develop a water resources vulnerability assessment training guidebook for tribal managers; and

4) help each tribe monitor and communicate short and long-term climate and related impact information through the development of quarterly climate summaries.

Knutson attended a kickoff planning meeting Nov. 29 to outline project activities in Rapid City, South Dakota. The following day, he provided an introductory presentation on conducting vulnerability assessments during a session of the GPTWA Fall Water Conference in Rapid City devoted to the project. During the session, other team members provided an overview of the project, the development of climate summaries, and how this project fits into other climate-related activities underway in the Missouri Basin.

Additional project workshops are planned to begin during the spring of 2017 with the project scheduled for completion in the fall of 2018.

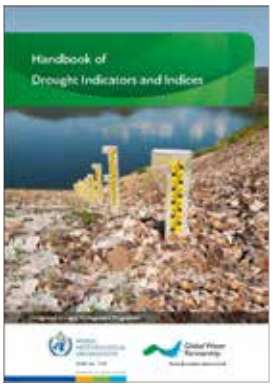
— CODY KNUTSON, NDMC

PARTNERS

DROUGHT GUIDEBOOK MOST COMPREHENSIVE CATALOG OF INDICATORS AVAILABLE

The Handbook of Drought Indicators and Indices brings into one resource guide 50 drought tools being used by planners and policymakers around the world.

The guidebook, written by Mark Svoboda and Brian Fuchs, climatologists with the National Drought Mitigation Center at University of Nebraska-Lincoln, and released by the Integrated Drought Management Programme, is available online. It is a part of the Integrated Management Tools and Guidelines Series compiled by the IDMP, a partnership of the World Meteorological Organization and the Global Water Partnership, and it has been translated into Arabic, Chinese, Spanish, French and Russian.



COURTESY IMAGE

"For a long time now, users of drought indicators for operational or research needs have been asking for a catalog of the most widely used indicators around the world," Svoboda said. "I believe we have put together one of the most thorough and up-to-date catalogs of indicators being applied today."

The publication gives an overview of available tools, programs and literature being used in drought-prone regions and includes where it originated and what data it utilizes. Each is further broken into classification – meteorology, soil moisture, hydrology, remote-sensing and composite or modelled – and then given an ease-of-use category, green being the easiest to access or use and red being the most data-intensive and complex.

Indicators and indices provide options for identifying the severity, location, onset, duration and cessation of drought conditions, according to the guidebook, and it's important to remember impacts vary by region and by season. It's also important to remember there is no one-size-fits-all definition of drought, Svoboda and Fuchs write. No single index or indicator can be applied to all types or areas affected by drought.

"The list of indices and indicators is a great starting point on what can be done with data available to a user and also where to go to find out more information," Fuchs said. "Starting with the Palmer Drought Severity Index in the 1960's to all of those currently listed in the guidebook, the science behind drought has come a long way and offers many opportunities to those wishing to do more in the way of monitoring as part of an early warning or planning system."

The "living document" will allow users to leave comments about what indicators they use in an online database, which could provide guidance to others battling drought. Their comments can highlight the strengths or weaknesses of tools, helping decision-makers choose the ones best-suited to their planning and drought mitigation needs. That interactive version of the drought guidebook is here: *droughtmanagement.info/indices.*

"These are the building blocks," Svoboda said about the tools presented in the publication. "How they can be applied is the next step."

Both Svoboda and Fuchs say this book is intended to be a reference, and both are looking to the future and the possibility of creating an application guide — maybe even a smartphone application — to accompany it. They want to see the tools available at people's fingertips.

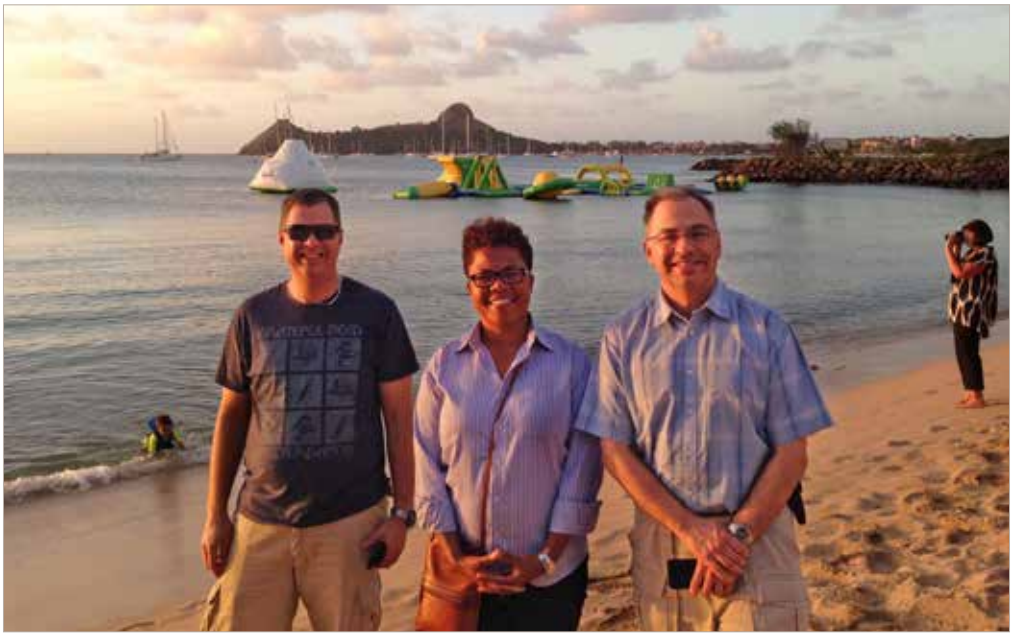
Perhaps literally.

— SHAWNA RICHTER-RYERSON, NDMC

CARIBBEAN NATIONS ADVANCE DROUGHT PREPAREDNESS

The National Drought Mitigation Center provided expertise in drought monitoring and planning in early 2016 to help Caribbean island nations take next steps in drought preparedness. Participants in the writeshops, organized by The Organization of Eastern Caribbean States Commission in collaboration with The Caribbean Institute for Meteorology and Hydrology, focused on creating and refining policy and planning documents that advanced drought preparedness in each territory.

In preparation for the writeshops, each participating country identified and assessed the gaps in existing legislation, policies, plans and other documents that pertained to drought preparedness, such as multi-hazard plans, and plans related to water, development, environment or land use.



From left, Brian Fuchs, Roché Mahon and Mike Hayes explored St. Lucia after the day's writeshop concluded.

Participants spent the last two days of the writeshops updating and drafting documents to take each nation's preparedness to the next step. They also strategized on best ways to present documents and recommendations to decision-makers for ratification and implementation. The four-day writeshops began with presentations on Caribbean drought monitoring and forecasting products and on best practices in drought planning, including talks by drought center staff on drought monitoring and planning.

Participating countries were St. Lucia, Antigua, Barbuda, St. Kitt's & Nevis, Dominica, Grenada, St. Vincent, Grenadines, Anguilla, the British Virgin Islands and Montserrat.

Severe drought in the Caribbean in 2015 continued into 2016 on some of those islands. Writeshops were conducted from January through March 2016, and the islands continue to refine their drafts.

— KELLY HELM SMITH, NDMC

2016 BY THE NUMBERS

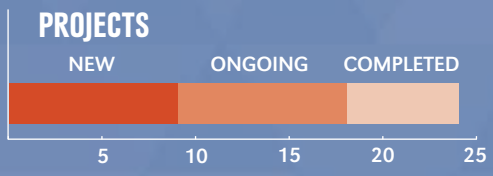
25 FACULTY & STAFF

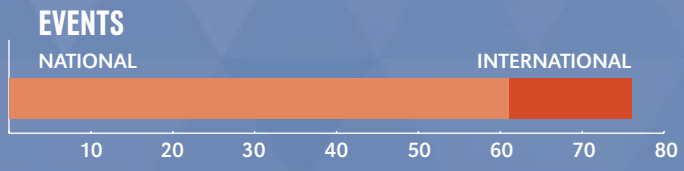
2 AFFILIATED FACULTY

42 VISITORS FROM 9 COUNTRIES

ACTIVITIES

24 PROJECTS & **76** EVENTS in 15 countries





SOCIAL MEDIA STATISTICS

1,546 RETWEETS

4,335 FOLLOWERS

14,514 REACH
Each post reaches an average of 182 people.

1,386 FOLLOWERS

6,050
MEDIA MENTIONS*

*Media statistics from Meltwater

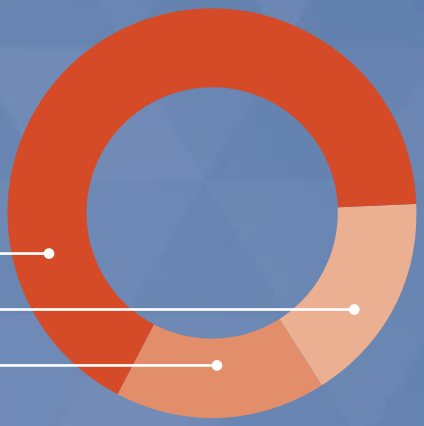
PUBLICATIONS IN 2016

24 Total publications

16 Peer-reviewed articles

4 Book chapters

4 Other reports



MONETARY IMPACT

$6
BILLION
Farm Bill Livestock Forage Disaster Program triggered by USDM since 2014.

$8.2
MILLION
Total active grants in 2016.

$41
MILLION
Ad Value Equivalence of drought center mentions in the media.*

$112
MILLION
Value of U.S. Drought Monitor mentions in the media.*

WEB STATISTICS

6.9M
PAGEVIEWS
of the U.S. Drought Monitor

14,327
VISITORS
to the Drought Impact Reporter

670,233
VISITORS
to the National Drought Mitigation Center website

WHERE WE WERE

National Drought Mitigation Center faculty and staff have always worked across the nation and around the world. The map shows locations where the drought center has collaborated on research, facilitated drought planning, shared technical knowledge, or provided programmatic advice through 2016. The numbered items highlight key projects or partnerships in 2016.

Dark blue indicates countries where we worked in 2016. The lighter blue indicates countries where we worked in the past.

1 Midwest Drought Early Warning System Meetings
*Ohio, Illinois, Iowa, Minnesota & Missouri**

The drought center joined the National Integrated Drought Information System to host Midwest DEWS workshops in five cities, fostering a network of drought planners.

2 National Science Foundation-Belmont Forum workshops
North Carolina, United Kingdom & Australia

Drought center faculty and staff on the Drought Impacts: Vulnerability thresholds in Monitoring and Early Warning Research (DrIVER) project hosted drought impact and indicator workshops in North Carolina and Australia, and contributed to a workshop in the United Kingdom to help prepare for drought and anticipate impacts.

3 Dubai UAE Meeting
Dubai, UAE

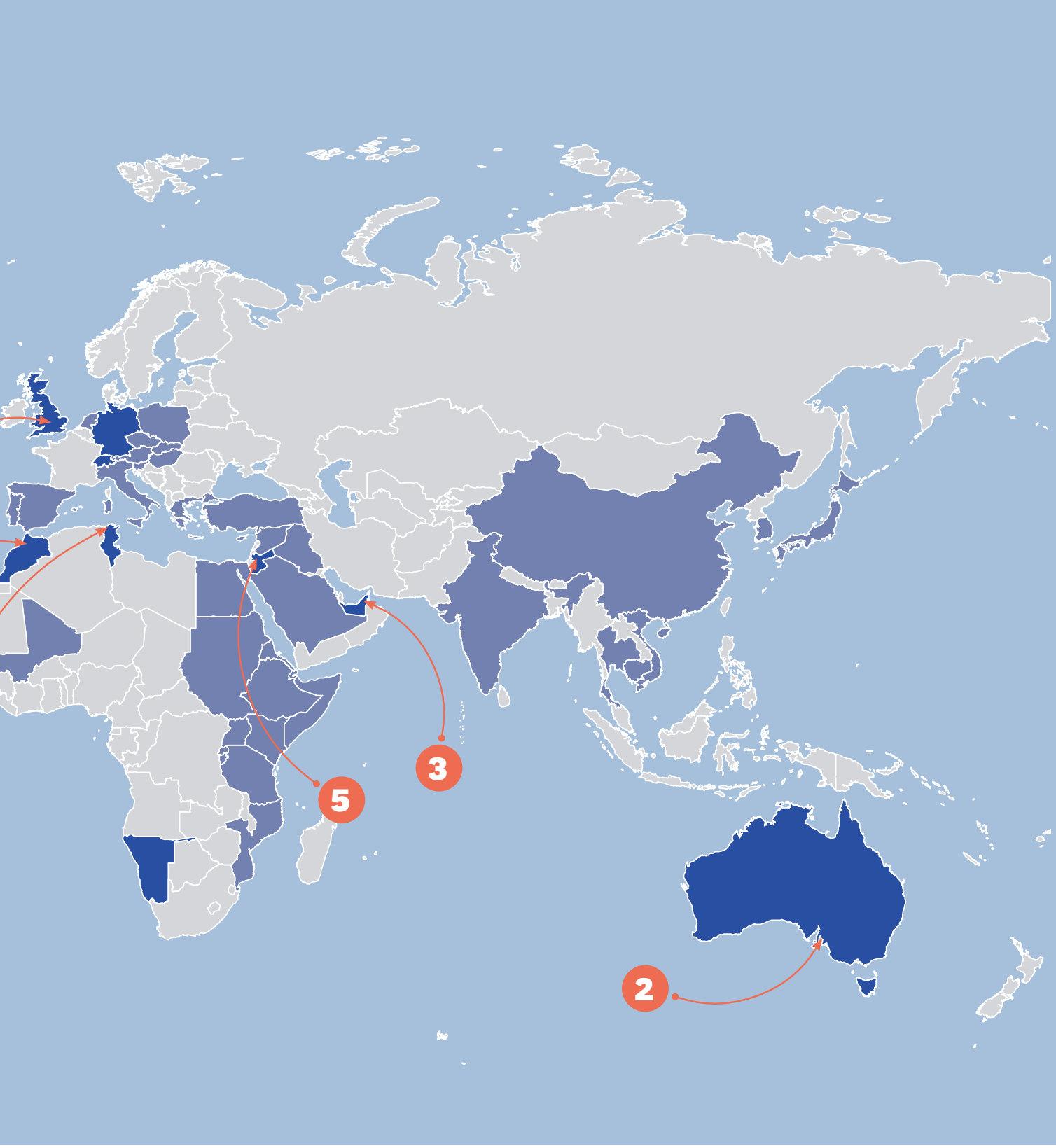
Drought center information technology staff worked with the International Center for Biosaline Agriculture to help transfer a new, composite drought index to open-source programming, paving the way for countries to tailor it to their own needs.

4 Great Plains Tribal Water Alliance Meeting
Rapid City, South Dakota

The drought center is working with the Great Plains Tribal Water Alliance as part of a collaborative South Dakota Tribes climate vulnerability assessment project.

5 MENA Stakeholder Meetings
Morocco, Jordan & Tunisia

The drought center's monitoring and stakeholder engagement experts organized and led meetings on drought management geared toward regional efforts in Morocco, Tunisia and Jordan.



6 Pacific Northwest DEWS Workshop
Boise, Idaho

We worked with drought planners from the Pacific Northwest on incorporating triggers and indicators into drought plans.

7 Intermountain Western DEWS Stakeholder Meeting
Oracle, Arizona

The drought center is contributing to development of a network of drought planners in the region.

8 Puerto Rico Drought Monitor Forum
Puerto Rico & Virgin Islands

We led a U.S. Drought Monitor user forum in Puerto Rico, with U.S. Department of Agriculture sponsorship.

9 NIDIS working groups and Engaging Preparedness Communities workshops
Lincoln, Nebraska

We organized a workshop for the Engaging Preparedness Communities working group of the National Integrated Drought Information System, as well as an all-working group co-chairs meeting.

10 Caribbean Drought Workshops
St. Kitt's, Antigua and St. Lucia

We helped the Caribbean Institute of Meteorology and Hydrology conduct four writeshops to help island nations enhance drought resilience.

11 Pacific Northwest DEWS Meeting
Portland, Oregon

The drought center is helping develop a network of drought planners in the region.

**Denoted by stars on map.*

Events numbered from most to least recent and are only highlights from the 76 events NDMC was a part of in 2016 .

1995-2015

20TH ANNIVERSARY IN NUMBERS

188 WORKSHOPS

5,000+ MEDIA CONTACTS

125 PUBLICATIONS

170 PEER-REVIEWED ARTICLES

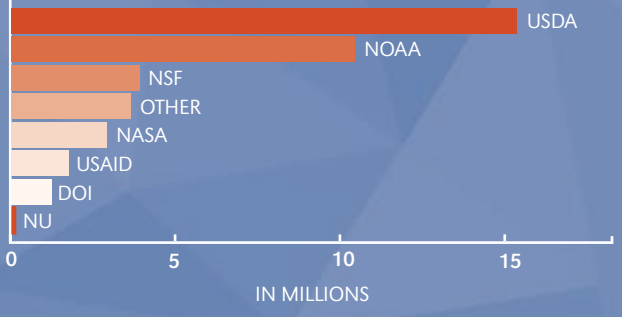
670 VISITING SCHOLARS

FROM **39** COUNTRIES

$39.2 MILLION IN FUNDING

* From the U.S. Department of Agriculture, National Oceanic and Atmospheric Administration, National Science Foundation, National Aeronautic and Space Administration, U.S. Agency for International Development, Department of the Interior, University of Nebraska (Foundation and Institute for Agriculture and Natural Resources Ag Research Division), and others.

OUR FUNDERS*



NDMC

Part of the Belmont DrIVER team visits a winery near Adelaide, Australia. Drought has had a huge impact on local wineries. Participants are from left: Neville Crossman with AU CSIRO; Nicole Wall and Mark Svoboda with NDMC; a doctoral student for CSIRO; Kerstin Stahl, project lead, University of Freiberg; Jamie Hannaford from U.K. CEH; and Kevin Collins from U.K. Open University.

DrIVER KEEPS EYE ON ANTICIPATING IMPACTS, PREPARATION

International experts gathered in December in Durham, North Carolina, and in March in Adelaide, Australia, to talk about anticipating drought impacts and preparation, part of the larger Drought Impacts: Vulnerability thresholds in monitoring and Early-warning Research, or DrIVER, project funded by the Belmont Forum.

Representatives of the water, agriculture, ecosystem and health sectors focused on what indicators of drought they use, what impacts are being recorded and which ones should be recorded and used in the future. NDMC representatives were:

- Mark Svoboda, head of the monitoring program area;
- Nicole Wall, public participation specialist;
- Cody Knutson, planning coordinator;
- Deborah Bathke, climatologist;
- Kelly Helm Smith, communication and planning specialist; and
- Elliot Wickham, graduate student.

The goal is to link the impact of droughts on communities, regions and industries with the traditional indicators of drought such as rainfall and soil moisture for better preparation for when droughts do hit. These were the third and fourth workshops in a series, with the first in December 2014 in the United States and the second in March 2015 in the United Kingdom.

DROUGHT RISK MANAGEMENT RESEARCH CENTER GETS TO WORK

The Drought Risk Management Research Center launched to conduct research to improve drought resilience across the United States. It is a partnership between the National Integrated Drought Information System and the National Drought Mitigation Center.

NIDIS supports the DRMRC through the National Oceanic and Atmospheric Administration's Sectoral Applications Research Program.

WHAT DOES THE CENTER DO?

The DRMRC is contributing to improved drought monitoring, impacts assessment and risk management by working with drought planners at state, local, tribal and regional scales to tailor information, processes and tools for their needs, including:

- supporting the growth of regional drought early warning systems and more geographically precise decision-making;
- improving processes for identifying drought impacts and vulnerabilities; and
- providing planning information and processes that meet specific needs.

The research and tools developed by the DRMRC will help communities, states and regions plan for, adapt to and recover from drought and water stresses. The DRMRC benefits anyone seeking to track drought and its impacts, address underlying causes of drought impacts, develop or update drought management plans, or understand and communicate the connections between drought's effects and strategies for minimizing losses.

We've already launched Dry Horizons, a monthly e-newsletter that highlights practitioners' success stories, shares new developments in the field, and allows people to raise questions.

WHAT HAVE WE DONE?

Through DRMRC, the drought center worked with regional, state and watershed drought planning efforts across the country in 2016.

We also were involved in each of the NIDIS Regional Drought Early Warning System efforts and contributed to specialized workshops, stakeholder meetings and other RDEWS initiatives as needed.

How can drought planning be less intimidating and more engaging? Even, dare we say it, fun? The drought center is investigating drought tournaments at a variety of scales, to learn how a gaming dimension can contribute to public involvement (See page 21).

Through DRMRC, and with the National Drought Resilience Partnership, the NDMC also presented a series of webinars on drought planning for watershed drought coordinators in Montana's Upper Missouri Headwaters Basin.

ON THE WEB

go.unl.edu/drmrc

TARIK ABDEL-MONEM, UNIVERSITY OF NEBRASKA PUBLIC POLICY CENTER

Participants generate ideas for drought planning during a drought tournament led by the North Platte Natural Resources District in Western Nebraska and by the National Drought Mitigation Center.

TOURNAMENTS HELP BROADEN PLANNING PERSPECTIVES

The drought center hosted and co-hosted several drought tournaments across the Midwest in 2016, with the goal of engaging stakeholders from a variety of sectors to talk drought and gain understanding of each group's needs in preparation for creating or updating state or regional drought plans.

The North Platte Natural Resources District and the National Drought Mitigation Center paired up for one such tourney in November in Scottsbluff, Nebraska.

The scenario event brought together stakeholders from the agriculture, finance, tourism, health, social services and veterans affairs sectors and broke them into four diverse teams. Teams then tackled three rounds of intensifying drought, all based on real-world 2012 drought conditions.

"Scenarios tapped into maps and real-life drought impact narratives that captured the socio-spatial aspects of decision making," said Nicole Wall, drought center outreach and research specialist. "People were empowered to work together and talk."

Participants felt they gained an appreciation for the challenges others outside of their sector face when drought does hit, and they felt better prepared to help the NRD define the most feasible and comprehensive local mitigation and response strategies to address drought hazards as the district works toward a new drought plan.

Goal achieved.

OTHER TOURNAMENTS

The National Drought Mitigation Center frequently pairs up with the National Integrated Drought Information System to facilitate drought tournaments. Those included tournaments in September with the U.S. Army Corps of Engineers in Cedar Rapids, Iowa, and in December with the Kansas Water Office in Emporia, Kansas.

UNIVERSITY COMMUNICATIONS

SVOBODA NAMED DIRECTOR OF DROUGHT CENTER

Mark Svoboda, climatologist and internationally known expert on drought monitoring and early warning, took over as director of the National Drought Mitigation Center, University of Nebraska on Oct. 1. Svoboda was one of the center's original employees at its founding in 1995.

"The deans of the Institute of Agricultural Sciences and Natural Resources are very pleased to welcome Dr. Svoboda to this director role for NDMC," said Archie Clutter, dean of the Agricultural Research Division at the University of Nebraska. "Mark is recognized locally, nationally and internationally for his expertise in climate science and drought mitigation, has contributed significantly to the science and operations of the center for more than two decades, and now will provide important leadership as the team plans the trajectory and integrated impacts of NDMC into the future."

Svoboda, who led the drought center's monitoring program area from 2006 to 2016, says monitoring drought is the relatively easy part. "The U.S. Drought Monitor map gets people's attention, and that leads to the question, 'What should we do about it?'" he said. "Our mission is to help people reduce the risk of drought." In addition to conducting research on drought monitoring for different scales and purposes, the center works with drought planners at all levels, from individual ranches to countries, to take action that reduces vulnerability to the next drought. The drought center works closely with the National Integrated Drought Information System, the National Oceanic and Atmospheric Administration, the U.S. Department of Agriculture and many other federal, state and international agencies.

As co-founder of the U.S. Drought Monitor in 1999, Svoboda was part of the team of scientists in federal agencies and universities around the country that created the process that uses a combination of data and expert judgment to map the location and intensity of drought each week. Having become

> **"I AM GRATEFUL AND EXCITED ABOUT THE OPPORTUNITY TO LEAD AND GROW SUCH AN OUTSTANDING CENTER AND STAFF INTO THE FUTURE."**

the country's state-of-the-art drought assessment product, the Drought Monitor has helped focus attention on drought as a hazard and also has become the mechanism for triggering certain federal agricultural relief funds.

Svoboda also serves on drought monitoring, assessment and prediction committees at state, regional and national levels, and has worked with drought, water and climate researchers in more than 50 countries and international organizations. A native Nebraskan, Svoboda earned his bachelor's, master's and doctoral degrees from the University of Nebraska-Lincoln, and rarely misses a home football game.

Donald A. Wilhite founded the NDMC in 1995 and served as director until 2006, when Michael J. Hayes, an agricultural meteorologist and an original NDMC employee, became the director. Hayes helped build the center through major grant and contract awards, and led it through a large-scale drought in 2012 that brought a new degree of focus to the issue. Hayes announced in 2016 that he would relinquish his leadership of the center to focus more on research and teaching as a faculty member in the Applied Climate Science program of the School of Natural Resources, where the NDMC is based.

Svoboda expressed appreciation for the efforts of administrators at the Institute of Agriculture and Natural Resources and the School of Natural Resources who have been involved in the center's leadership transition. "I am grateful and excited about the opportunity to lead and grow such an outstanding center and staff into the future," Svoboda said. "Having been with the center from the beginning, it is a real honor and privilege."

— KELLY HELM SMITH, NDMC

NDMC

Mike Hayes, at the time director of the National Drought Mitigation Center, speaks during the 20th anniversary celebration of the drought center in April 2016 at the International Quilt Study Center and Museum in Lincoln.

HAYES STEPS DOWN AS NDMC DIRECTOR

Oct. 1, 2016. On that date, Mike Hayes officially stepped down as director of the National Drought Mitigation Center and transitioned to his new role as a faculty member and research climatologist at the School of Natural Resources, also at University of Nebraska-Lincoln.

"I have found over the years, drought is just a fascinatingly complex topic," he said, reflecting on his time as director. "Drought is so different in each location that it's a tremendously exciting field to be in. ... I will miss it."

Hayes, one of the original staff members of the drought center, started as director of the NDMC in August 2007. At that time, the center was in the midst of a large grant project from the U.S. Department of Agriculture Risk Management Agency — its major source of funding — but knew its future beyond that grant was uncertain.

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UNIVERSITY COMMUNICATIONS

NDMC FOUNDER, DROUGHT LEGEND RETIRES

After nearly 40 years with the University of Nebraska-Lincoln, Don Wilhite, founding director of the National Drought Mitigation Center, former School of Natural Resources director and dedicated applied climate professor, has retired and has shifted to emeritus status.

June 30 was his official last day.

"It's been a great honor to work with the university since I joined the faculty in 1977," Wilhite said. "On both the domestic and international side, it has been very rewarding to see my emphasis on drought preparedness and drought policy as well as my emphasis on the development of drought early warning systems and vulnerability assessments being adopted as part of NOAA's National Integrated Drought Information System and by agencies of the United Nations such as the World Meteorological Organization, the U.N.'s Convention to Combat Desertification and the U.N.'s Food and Agriculture Organization."

Wilhite was the founding director of the International Drought Information Center in 1989, which focused at an international level on reducing vulnerability to drought through projects directed at planning, early warning and mitigation. The center created a guidebook on drought preparedness for developing countries, organized training seminars and conferences related to drought and water resource management, and helped shape drought policy.

This work took him to Africa, Brazil, Thailand, China, Switzerland and Uruguay, among dozens of others countries that were seeking advice for drought planning. The IDIC was active until 2002.

In 1995, Wilhite founded the National Drought Mitigation Center, whose focus has been on reducing societal vulnerability to drought, nationally and internationally, through the development of preparedness plans that emphasize proactive mitigation measures and the adoption of national drought policies that are focused on risk reduction. The NDMC may be best-known for its work on the U.S. Drought Monitor, a weekly map of drought conditions. Countries around the world have sought to emulate the map for their own drought response.

Wilhite served as the director of the NDMC until 2007, when he was appointed director of the School of Natural Resources. He stepped down from that post in 2012 to rejoin the Applied Climate Science faculty. His focus since has been on fostering drought management policy internationally and on climate change and its impacts on the state.

Some of his other posts over the years have included:

- Co-organizer of a November 2015 workshop on the Implications of a Changing Arctic on the Water Resources and Agriculture of the Central United States. This workshop was sponsored by NOAA, USDA and the University of Nebraska and is associated with the U.S. chairmanship of the Arctic Council, which began in April 2015.
- Co-chair of the organizing committee for the 2014 annual symposium of the Center for Great Plains Studies, Drought in the Life, Cultures, and Landscapes of the Great Plains.
- Fellow at the Robert B. Daugherty Water for Food Global Institute at the University of Nebraska.
- Chairman of the Management and Advisory Committees of the newly formed Integrated Drought Management Program launched by the World Meteorological Organization and the Global Water Partnership in 2013.
- Chairman of the International Organizing Committee for a High-Level Meeting on National Drought Policy sponsored by the World Meteorological Organization, the Food and Agriculture Organization and the United Nations Convention to Combat Desertification, July 2011 to March 2013.
- Co-chair of the executive council for the National Integrated Drought Information System, NOAA, 2007 to 2016.

"Don has made tremendous contributions throughout his career here at UNL," said Michael Hayes, former director of the NDMC. "He has been a vital member of the climate group first within the Department of Agricultural Meteorology and then the School of Natural Resources. However, one achievement forever credited to Don will be his vision for proactive drought risk management. Don's vision has spread around the entire world, with both national and international legacies, as well as leading to the creation of the National Drought Mitigation Center with its mission to support drought risk management."

— SHAWNA RICHTER-RYERSON, NDMC

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"It was a pivotal point," he said. "But we were able to sustain where we were going and take the NDMC beyond its beginnings."

The center not only continued to thrive, but grew to a staff of 22 and continued to expand its work on projects across the United States and internationally, too. It also continued to build partnerships and programs to reduce drought vulnerabilities, including with the National Integrated Drought Information System to develop drought early warning systems across the U.S.

"We and NIDIS saw how we could complement one another," he said, "so we became two entities working together instead of in competition."

The center also focused heavily on taking drought risk management from theory to application. It promoted a process meant to reduce drought vulnerabilities in a way that targeted an individual nation's or state's needs. Drought in the rainforest, for example, looks much different than drought in the Midwest and ways to reduce the impacts of drought in those places also look much different.

But that's what made it fun for Hayes and why he won't completely separate from the topic in his new role as a climatologist and researcher with SNR's newly combined mission area: Applied Climate and Spatial Science. Instead, he'll broaden his focus from drought to include disaster, extreme events and climate, as well as how they affect society and society's preparations. He also plans to help develop and grow SNR's new mission area so its unique qualities shine through for students.

"There is a tremendous skillset of people in SNR," he said. "We have incredible talent, and it's exciting to be a part of that."

It helps knowing the drought center was in a good position to hand off, with funding and projects secured for at least several years. He can walk away knowing he helped shepherd the center through transition and has passed off the leadership duties to another NDMC original staffer, Mark Svoboda.

Two bookends to a successful span at the NDMC.

— SHAWNA RICHTER-RYERSON, NDMC

OUR TEAM

LEADERSHIP

Dr. Mark Svoboda
Director

Kelly Helm Smith
Assistant director & communication coordinator

Dr. Deborah Bathke
Education coordinator

Brian Fuchs
Monitoring coordinator

Dr. Cody L. Knutson
Planning coordinator

Dr. Tsegaye Tadesse
Geospatial coordinator

STAFF

Tonya Bernadt
Education and outreach specialist

Karin Callahan
GIS and remote sensing specialist

Ann Fiedler
Administrative assistant

Denise Gutzmer
Drought impact specialist

Tonya Haigh
Project manager

Dr. Theresa Jedd
Post-doctoral researcher

Jeff Nothwehr
GIS and web specialist

Chris Poulsen
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Shawna Richter-Ryerson
Communications associate

Curtis Riganti
Climatologist

John Swigart
Geospatial analyst

Nicole Wall
Outreach and research specialist

Deborah Wood*
Publication specialist

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Graduate research assistant

Andualem Shimeles Shiferaw
Graduate research assistant

Elliot Wickham
Graduate research assistant

VISITING SCIENTISTS

Yared Bayissa
Research scientist

Dr. Getachew Demisse
Post-doctoral researcher

** Not pictured*

PARTNERSHIPS

- National Aeronautic and Space Administration
- National Centers for Environmental Information (National Oceanic and Atmospheric Administration)
- National Integrated Drought Information System
- National Science Foundation
- National Weather Service (NOAA)
- NOAA Sectoral Applications Research Program
- NOAA Coping with Drought Initiative
- Southern Climate Impacts Planning Program
- United Nations Environment Program
- U.N. Food and Agriculture Organization
- U.N. World Meteorological Organization
- University of Nebraska-Lincoln & associated centers
- U.S. Agency for International Development
- U.S. Bureau of Reclamation
- U.S. Department of Agriculture
- USDA Risk Management Agency
- U.S. Department of Interior Bureau of Indian Affairs
- U.S. Geological Survey

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